RS-Int
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Seed

RESULTS OF THE ANALYSES OF 1936 TREE CLASS CONE STUDY DATA

In analyzing the 1936 tree class cone study data the form of analysis of variance outlined by Snedecor was used in those portions of the computations relating to tree classes, D.B.H. classes, age classes and location of the sample trees. Relations between tree variables, other than those named above, cone variables and seed variables were computed by the methods outlined by Snedecor for linear regressions. Correlation coefficients were also calculated, as a matter of interest, from the regression data.

The tree classes used are those described by Dunning. D.B.H. classes of six inch intervals were used ranging from 4"-9" (3.6"-9.5") to 40"-45" (39.6"-45.5"). Fifty year age classes ranging from 0-50 years to 301 years and older were employed in analyzing the data on the basis of age of the trees.

As stated in the "Supplement to Working Plan", the more important variables to be derived from this phase of the study are those relating to size of cones, number of seed per cone, and viability of seed, all in relation to size and class of tree. Therefore, the results of those analyses are presented first in the list that follows.

Variance Analyses

On basis of TREE CLASS

1. Percentage of seed germinating in 48 days--no significance.

The term "no signifiificance" may be understood to infer that the differences between means tested are not markedly greater or smaller than the differences encountered within the means. Or, in other words, these means do not vary more than would be expected in random sampling from a homogeneous, normally distributed population.

2. Percentage of viable seed--significant.

The difference in percentage of viable seed, as determined by the float test, between the seven tree classes was found to be greater than can be accounted for by purely random sampling. That is, the percentages of viable seed are features of tree class, varying from one class of tree to another. Observation of the data indicates that class six trees had the highest viability with 90.6%. The remaining classes were in the order 7, 1, 5, 4, 3, and 2--class 2 being lowest with a viability percentage of 74.1. It should be noted that the difference between classes was barely significant. An F value of 2.26 was required for significance at the 5% point, and an F value of 2.28 was actually obtained from the analysis of the data. This indicates that further data on the relation between tree class and percentage viability should be collected and analyzed to substantiate the results already obtained.

3. Number of seed per cone--no significance.

4. Number of cones per tree--no significance.

5. Length of cones--no significance.

On basis of D.B.H. CLASS

1. Percentage of seed germinating in 48 days--no significance.

2. Percentage of viable seed--no significance.

3. Number of seed per cone--no significance.

4. Number of cones per tree--significant.

It was found from the data collected that there was a marked difference in the number of cones per tree between the various D.B.H. classes used. The 34"-39" class had the highest number of cones per tree with a mean of 992.5. The 28"-32" class was next with a mean of 324.7 and the 4"-9" class was found to be lowest with an average of 29.0 cones per tree. The D.B.H. classes ranged from the greatest to the least average number of cones as follows: 34"-39", 28"-33", 16"-21", 40"-45", 22"-27", 10"-15", and 4"-9". Due to the small number of trees in the smallest and the largest two D.B.H. classes, it would probably be well to repeat this analysis with more complete and better balanced data. Too much importance should not be attached to the results obtained from the data used.

5. Length of cones-significant.

It was found that the D.B.H. of the trees sampled had a marked affect upon the length of the cones obtained from that tree. Cones from 10"-15" trees were longest with a mean length of 3.26", and cones from 34"-39" trees were shortest with a mean length of 2.58". The failure of cone lengths to vary consistently with increasing or decreasing tree diameters suggests that further work be devoted to this relation.

On basis of AGE CLASS

1. Percentage of seed germinating in 48 days--no significance.

2. Percentage of viable seed--no significance.

On basis of LOCATION OF TREE

1. Percentage of seed germinating in 48 days--no significance.

2. Number of seed per cone--no significance.

In order to preclude the possibility of variables other than those it was desired to test from affecting the germination of the seed collected, the average and the standard deviation of the number of seed germinating in the greenhouse sand flats was calculated. It was found that there was no significant variation in percentage of germination between the flats themselves, thus indicating that conditions encountered in the greenhouse affected all seed flats to the same degree.

Regression Analyses

1. Relation between percentage of viable seed and percentage of seed germinating in 48 days--highly significant.

There was found to be a very strong positive relation between the % viable seed and the % germinating in 48 days. The greater the % viable, as determined by the float test, the greater the % germinating in 48 days. A correlation coefficient of 0.526 was calculated.

2. Relation between cone length and percentage of seed germinating in 48 days--no significance.

3. Relation between cone length and percentage of viable seed--no significance.

4. Relation between number of cones per tree and percentage of viable seed (omitting trees in 4"-9" D.B.H. class)--highly significant.

Due to the small number of cones found on trees of the 4"-9" D.B.H. class, those trees were not used in this analysis. On the basis of the remaining 61 trees there is very conclusive evidence of a population relation between the two variates tested. The greater the number of cones per tree the greater is the percentage of viable seed. A correlation coefficient of 0.350 was obtained.

5. Relation between number of seed per cone and percentage germinating in 48 days--no significance.

6. Relation between cone volume and percentage of seed germinating in 48 days--no significance.

7. Relation between weight per 100 of seed without wings and percentage of viable seed--highly significant.

The results of this analysis showed that the heavier the seed, the greater was their % viability. A correlation coefficient of 0.445 was obtained.

8. Relation between weight per 100 of seed without wings and percentage germinating in 48 days--highly significant.

Due to the high degree of relation between % viable seed and % germinating in 48 days and the weight per 100 of seed without wings and % viability already pointed out above, we might expect a similarly strong relationship to exist between weight per 100 of seed without wings and % germinating in 48 days. This was found to be true as evidenced by a correlation coefficient of 0.442. Thus we may say that, from the population sampled, the heavier seed showed the greatest percentage germination in 48 days.

In the ~~seven~~ eight relationships described above we have been primarily concerned with seed viability and germination and the factors affecting them. We shall now take up the effect of certain factors on such variables as number of cones per tree, cone size and weight, number of seed per cone, and seed weight.

1. Relation between number of cones per tree and length of cones--no significance.

2. Relation between crown volume and number of cones per tree--no significance.

Crown volume was calculated by the formula:

$$V = \pi \frac{D^2}{4} \times L$$

V--crown volume in cubic feet
π--3.1416
D--average crown width in feet
L--crown length in feet

3. Relation between weight per 100 of seed with wings and weight per 100 of seed without wings (omitting trees #46 and #52)--highly significant.

The trees mentioned were omitted due to the fact that data for the weight per 100 of seed with wings for those two trees were not available. As might be expected an extremely high positive correlation exists between the weight per 100 of seed with and without wings, a correlation coefficient of 0.982 being obtained.

4. Relation between green weight and dry weight of cones--highly significant.

Again as might be expected, an almost perfect relation was found to exist between green and dry weight of the cones sampled. The greater the green weight of the cones, the greater was the dry weight as shown by the correlation coefficient 0.937.

5. Relation between cone volume and dry weight of cones--highly significant. The cone volumes were calculated from a mathematical expression and were not determined by any form of direct measurement. The expression used was computed by means of multiple regression using the data for maximum diameter squared, length and volume (as determined by displacement) of 35 sample cones collected and measured for another study. The expression was found to be:

$$E = 22.34\ X_1 + 25.06\ X_2 - 77.03$$

E--calculated volume in cubic centimeters

X_1--maximum cone diameter squared in square inches

X_2--cone length in inches

The data for average length and average diameter squared of the cones of the 65 trees sampled in this study were substituted in the above regression equation in order to obtain the average volume of those cones. Using the volume data thus obtained it was found that the dry weight of cones increased with an increase in their volume. The correlation coefficient was 0.859--sufficient for high significance.

6. Relation between dry weight of cones and weight per 100 of seed without wings--highly significant. This analysis gave strong evidence that the heavier, and therefore probably larger cones, produced heavier seed. The correlation coefficient

obtained from these two variables was 0.393.

7. Relation between dry weight of cones and weight per 100 of seed with wings--highly significant.

Due to the very pronounced relationship found to exist between the weight per 100 seed with and without wings we would therefore expect the results of this analysis to be similar to those obtained for the one described under number 6 above. This was found to be the case for the weight per 100 of seed with wings increases with the dry weight of the cone, indicating that the heavier cones produce heavier seed. The correlation coefficient in this instance was 0.450.

8. Relation between dry weight of cones and number of seed per cone--highly significant.

As might be expected, this analysis shows that the heavier cones produce more seed than the lighter cones. Correlation coefficient--0.335.

9. Relation between cone volume and number of seed per cone--highly significant.

Observation of the results of this analysis shows that the larger cones--those having greater volume--produce a greater number of seed than do smaller cones. Correlation coefficient--0.353.

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